[0083] On the other hand, a weight for a feature which is not input among features of the input layer becomes zero and may be excluded from the blood pressure estimation.

[0084] Hereinafter, a method of learning the ANN algorithm is described.

[0085] FIG. **6** is a flowchart showing a method of learning the ANN algorithm.

[0086] Referring to FIG. **6**, a training set may be selected for each group classified in accordance with hemodynamic characteristics as described in relation to FIG. **3**. The ANN algorithm for each group may be prepared through learning the ANN algorithm with respect to the selected training set.

[0087] The blood pressure estimation may be performed by using the learned ANN algorithm.

[0088] FIG. **7** is a flowchart schematically illustrating a method of estimating blood pressure according to another exemplary embodiment. The method is explained with respect to FIG. **1**.

[0089] Referring to FIG. **7**, biometric information of a subject may be input (operation S**410**). The biometric information may be input via the biometric information unit **150**. The biometric information of the subject may include physical characteristic information such as sex, age, height and arm length of the subject, and may also include blood pressure information of the subject.

[0090] The blood pressure information may include the systolic blood pressure and the diastolic blood pressure.

[0091] When the biometric information of the subject are already stored in the memory **140**, the operation S**410** may be omitted.

[0092] Then, bio-signal of the subject may be detected (operation S**420**). A laser beam may be emitted from a light emitter **112** to a radial artery of the subject. A light receiver **114** may receive light reflected from the radial artery. The bio-signal detected by the light receiver **114** may be a PPG signal.

[0093] Then, a plurality of features may be extracted from the detected bio-signal (operation S**430**). The plurality of features may include, for example, a systolic peak P**1**, a reflective peak P**2**, a systolic rising time t**1**, a reflective peak time t**2**, and a period t**3**.

[0094] Then, the blood pressure corresponding to the physical characteristic information, the blood pressure information and the features may be estimated by using the learned blood pressure estimation algorithm (operation S**440**).

[0095] The blood pressure algorithm may be the ANN algorithm.

[0096] The physical characteristics information, the blood pressure information and the features may be input to an input layer (Input Layer of FIG. **5**). The subject may be algorithmically classified as belonging to one of the plurality of groups, similar to the classification with respect to hemodynamic characteristics, according to the blood pressure information and age of the subject input to the input layer.

[0097] Output values, for example, the systolic blood pressure and the diastolic blood pressure may be estimated by matching the physical characteristic information, the blood pressure information and the features to the hidden layer matrix of the one of the plurality of groups.

[0098] Since blood pressure information, physical characteristic information and features of the subjects are input during the learning process of the ANN algorithm, a classification of input values such as the blood pressure information and the physical characteristic information of the subject may be internally performed, and blood pressure may be estimated based on the ANN algorithm which is internally classified in accordance with hemodynamic characteristics.

[0099] According to another exemplary embodiment, features, physical characteristic information, and blood pressure information of the subject may be input to the input layer, and the systolic blood pressure and the diastolic blood pressure of the blood pressure information may be input to the output layer for the learning of the ANN algorithm.

[0100] For the learning of the ANN algorithm, diversified data of subjects may be needed such that each of the feature, the physical characteristic information, and the blood pressure information may evenly contribute to the output information.

[0101] The learning of the ANN algorithm according to another exemplary embodiment may reduce a learning time compared with that of the learning of the ANN algorithm described in relation to FIG. **6**.

[0102] The method of estimating blood pressure according to one or more exemplary embodiments may also be embodied as computer readable codes on a non-transitory computer readable recording medium. The non-transitory computer readable recording medium is any data storage device that can store data which can thereafter be read by a computer system. Examples of the non-transitory computer readable recording medium include read-only memory (ROM), random-access memory (RAM), CD-ROMs, magnetic tapes, floppy disks, optical data storage devices, etc. The non-transitory computer readable recording medium can also be distributed over network coupled computer systems so that the computer readable code is stored and executed in a distributive manner.

[0103] According to a method of estimating blood pressure, the ANN algorithm is performed with regard to persons belong to the same group divided by hemodynamic characteristics, and therefore an accuracy of the estimation of blood pressure is improved.

[0104] The foregoing exemplary embodiments are merely exemplary and are not to be construed as limiting. The present teaching can be readily applied to other types of apparatuses. Also, the description of the exemplary embodiments is intended to be illustrative, and not to limit the scope of the claims, and many alternatives, modifications, and variations will be apparent to those skilled in the art.

What is claimed is:

1. A method of estimating blood pressure, the method comprising:

inputting physical characteristic information and blood pressure information of a subject;

determining, among a plurality of groups classified according to hemodynamic characteristics, a group to which the subject belongs based on the physical characteristic information and the blood pressure information;

detecting a bio-signal of the subject;

extracting a plurality of features from the detected bio-signal; and

estimating a blood pressure corresponding to the extracted plurality of features and the determined group based on a learned blood pressure estimation algorithm.